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Abstract

FABRICATION OF URANIUM OXIDE FUEL ELEMENTS AT TROMBAY

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Uranium oxide is being increasingly used as a fuel, especially in power reactors, on account of its superior properties, chief among them being corrosion resistance and stability under irradiation leading to high burn up. A 19-rod cluster type of fuel element has been favoured for the proposed prototype power reactor NUHMOC from considerations of high specific power. The present fuel elements were fabricated for studying the physics parameters in the zero energy reactor, ZERLINA.

The paper is concerned with the fabrication of the 19-rod fuel clusters starting from the production of ceramic grade uranium oxide powder. The uranium oxide has been prepared under different conditions, using gaseous or liquor ammonia or other

reagents for precipitation, and by varying the conditions of calcination and reduction. The conditioning of the powder to minimise its pyrophoric tendency and to achieve a desirable O/U ratio has been studied. The effect of the physical characteristics of the powder such as particle size, specific surface, bulk and tap densities on the ultimate sintered densities has been investigated.

The various steps involved in the fabrication of the uranium oxide pellets such as granulation, blending, compacting, dewaxing, and sintering have been dealt with. The effect of die taper in die design, pressing conditions, the effect of various atmospheres, such as vacuum, carbon dioxide and nitrogen, during dewaxing have been studied. Similarly the conditions of sintering have been varied to achieve high sintered densities at as low a sintering temperature as possible.

The sintered pellets are centreless and surface ground prior to assembly and these aspects have been briefly discussed. The assembly of the machined uranium oxide pellets into 1S-aluminium tubes (14.4 mm i.d., 0.7 mm wall thickness and 2429 mm long), the end-closure by argon arc fusion welding, and their assembly into 19-rod clusters are described. A complete charge of the fuel loading for test purposes on Zerlina will be ready by the middle of 1964.